



**Statement Of Work For The Fabrication Of A 100 Kilovolt Ion Accelerating Tube  
For The Electron Beam Ion Source.**

**PO #102488 Budker Institute of Nuclear Physics  
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**1.0 General:**

- 1.1 The Accelerating Tube, AT, will be required to accelerate all ion species, protons to uranium, from the high voltage platform of the ion source to the ground potential of the Low Energy Beam Transport, (LEBT).
- 1.2 The Accelerating Tube must be able to match at high efficiency ions from the Electron Beam Ion Source, (EBIS), into the LEBT system through a series of copper electrodes insulated by ceramic rings.
- 1.3 The column will operate at high vacuum.

**2.0 Electrical Requirement:**

- 2.1 Typical operating voltage across the Accelerating Tube will be 100 Kilo-volts pulsed. The tube must be capable of continuous operation at 110 KV.
- 2.2 Pulsed repetition rate will be 200 micro-sec at 5 pulses per second, PPS, 0.1 % duty.
- 2.3 Maximum leakage current across the accelerating tube to be 5 micro-amps.
- 2.4 Typical operating ion current will be 25 micro-amps peak for 10 to 100 micro-sec in length at 5 PPS.
- 2.5 Accelerating gradient, voltage flatness, will be maintained at <1% across the unloaded Tube.

**3.0 Mechanical Requirements:**

- 3.1 The Accelerating Tube must have 2 standard Conflat flanges of ID 12" on each side. Material to be 304 stainless steel.
- 3.2 The design should allow for the free use of bolts or studs with nuts and washers for connecting the flanges to parts of the ion source and LEBT.
- 3.3 The outer diameter of the ceramic rings should be 10" or 250 mm. The inner diameter of the rings and electrodes should be not smaller than 8" (203 mm).
- 3.4 The electrodes should extend beyond the OD of the ceramic rings to provide for connecting additional electrodes and resistors.

- 3.5 The outside parts of the electrodes should have threaded 4-40 holes for this purpose.
  - 3.6 The length of insulator should be minimal to withstand the abovementioned voltage. The number of ceramic rings should be 10.
  - 3.7 All materials used for manufacturing the Accelerating Tube should be non-magnetic and Ultra-High Vacuum compatible. Typical operation will be at vacuum pressure of  $10^{-9}$  Torr or less. The electrodes between the ceramic rings should be made of oxygen free copper.
- 4.0 Fabrication and Testing:
- 4.1 Only vacuum oven brazing of the AT elements is acceptable. The design should exclude corona discharge on either side of AT electrodes.
  - 4.2 A helium vacuum leak test must be performed. The total helium leak rate should be  $< 1 \times 10^{-10}$  cm<sup>3</sup>/s. With the AT enclosed in a bag filled with helium at 15 psi.
- 5.0 Documentation:
- 5.1 Documentation must include a confirmation statement agreeing to BNL's design, fabrication, and material selections.
  - 5.2 Final test data, at a minimum, must include:
    - 5.2.1 Vacuum test results
    - 5.2.2 Due to the high voltage pulsed operation of the AT leakage current across the AT shall be  $< 5$  micro-amps measured for a duration of 10 seconds.
    - 5.2.3 Voltage shall be measured at several points along the AT to insure a 1% voltage droop in gradient flatness.

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